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A New *Cryptococcus* Species from North America, with a Key to the Species of the Genus (Homoptera: Coccoidea)*

Abstract—Morphological descriptions and illustrations are given of the adult female and first-instar nymph of *Cryptococcus williamsi* new species. Numerical analyses of morphological characters were conducted as far as material was available. This scale insect is a pest of sugar maple trees in the states of Maine, New Hampshire, New York, and Vermont in the United States, also in some parts of Ontario and Quebec in Canada. A key to the species of *Cryptococcus* is given.

The genus *Cryptococcus* was erected by Douglas in 1890 (1), with the type species *Coccus fagi* Baerensprung (1849). Since that time only two additional species have been assigned to this genus: *C. nudatus* Brittin (1915) (2), and *C. aceris* Borchsenius (1937) (3). *Cryptococcus fagi* infests only beech trees, was the only species previously known from North America, and probably was introduced from Europe. *C. nudatus* is known from *Hoheria* species in New Zealand, while *C. aceris* was described from unidentified maple and linden trees from Abkhazia, Azerbaidzhan, Russia.

Adults and first-instar nymphs of the new species were studied, and both instars are here described and illustrated. Immature stages of the other species of *Cryptococcus* have not been described. Numerical analyses of morphological characters have been conducted in both stages, to show the means and variation among the specimens studied. A proposed new family description follows the new species description.

Cryptococcus williamsi, new species
Suggested common name: maple bark scale

Adult Female

Plate 1

Female Covering: Fine threaded, white, wooly secretion.

DESCRIPTION: Somewhat oval in general appearance (fig. a). Total length 684 μ (606–857); mean width 564 μ (458–679). Ranges of measurements are given in parentheses. Dry females brownish orange, live ones salmon-orange in color.

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DORSAL SURFACE

Tubular ducts (fig. b): Numerous, about 10 μ long and 7 μ in diameter, more or less evenly distributed throughout the body, some on margin.

Quinquelocular disc pores (fig. c): Few occurring submarginally.

Trilocular disc pores (fig. d): Usually 1 or 2 present on the head and on the thorax.

Simple disc pores (fig. e): Scattered in the submarginal area.

Setae (fig. f): Thin, about 10 μ long, distributed on both surfaces of the body in no definite pattern.

VENTRAL SURFACE

Antennae (fig. g): Reduced to short tubercles, approximately 17 μ long, 12 μ in diameter at the base, and usually bearing 3–4 small setae.

Labium: Triangular in shape, 50 μ long (31–86), and 46 μ wide at base (27–55); bearing 2 short setae on each side.

Clypeolabral shield: 99 μ long (78–168); width 86 μ (63–125). Stylets usually coiled in a loop, when extended not reaching beyond the apex of the abdomen.

Legs: Entirely absent.

Anterior spiracles (fig. h): 37 μ long (27–51); atrium 25 μ in diameter (20–31), surrounded by a sclerotized area bearing 2–4 (mean 3.33) quinquelocular disc pores.

Posterior spiracles: More or less identical with anterior pair; 30 μ long (23–63); atrium 25 μ wide (17–35), surrounded by a sclerotized area bearing 2–5 (mean 3.23) quinquelocular disc pores.

Cluster pore plate (fig. i): Compact cluster of 5–12 (mean 8) sievelike pores present in an oval plate posterior to each posterior spiracle.

Anal ring (fig. j): Borne on the ventral surface on the body close to the caudal apex, consisting of a heavily sclerotized ring, 18 μ in diameter (16–23). The ring bears 4 setae, 9 μ long (7–16), the posterior pair being the shorter.

Anal tube (fig. j): Length, 15 μ (12–23); with one pair of setae about 6 μ long at its innermost margin. Five pairs of setae surrounding the anal ring, the median pair about 10 μ long, the others about 5. Vulva distinct.

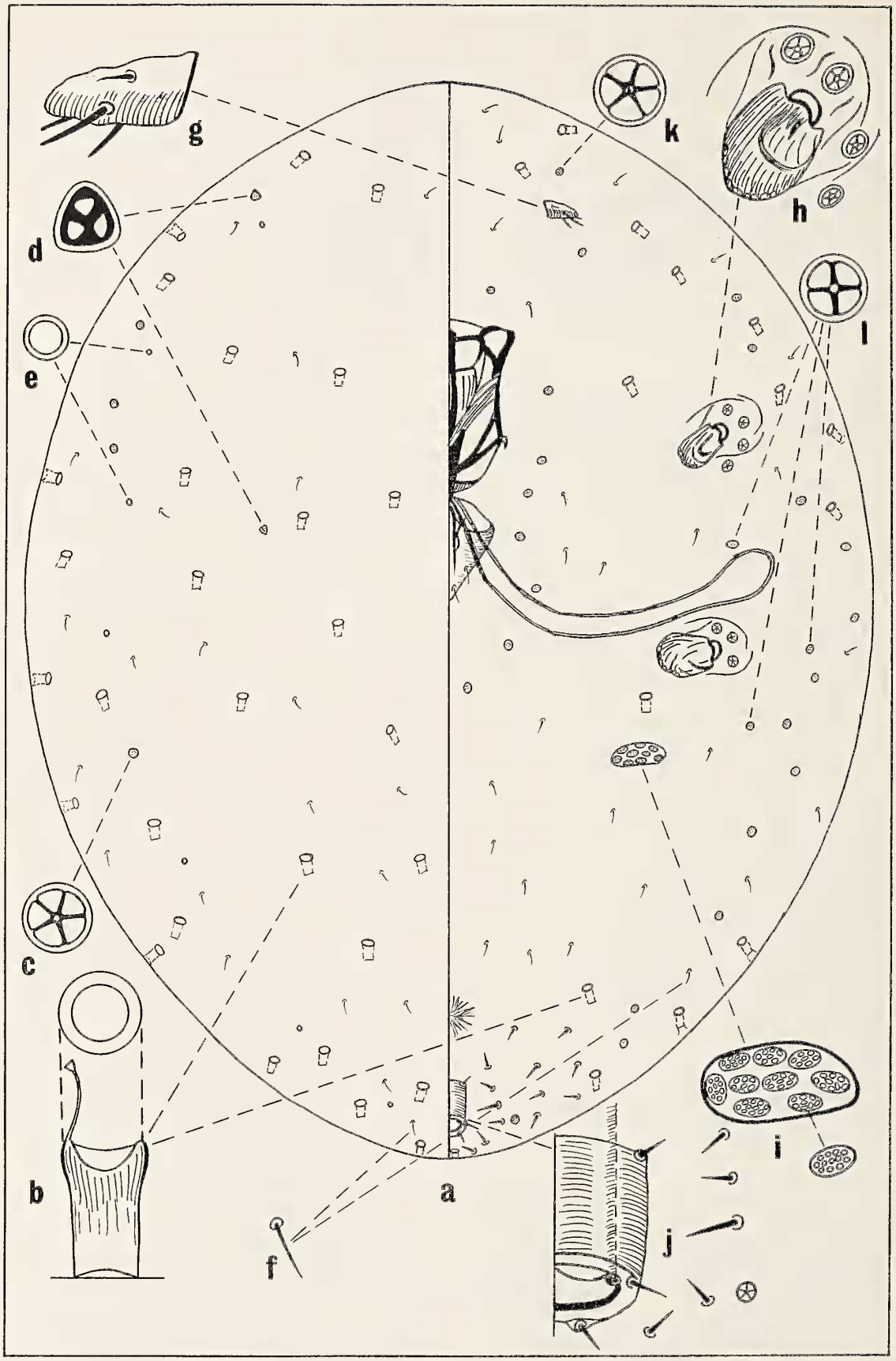

Plate I.— Cryptococcus williamsi sp. n., female

Tubular ducts (fig. b): About 88, most arranged submarginally.

Quinquelocular disc pores (fig. k): About 4 μ in diameter, arranged submarginally and irregularly around the mouthparts.

Quadrilocular disc pores (fig. l): Few, scattered near the spiracles.

Material studied: 101 adult females were available for this description, but the means and ranges were calculated from 42 selected specimens.

First-Instar Nymph

Plate 2

DESCRIPTION: Body (fig. a) elongate ovoid. Mean length of six specimens 319 μ (293–344); mean width of three specimens 182 μ (168–203). Numbers after the range of morphological characters refer to the size of the sample.

DORSAL SURFACE

Quinquelocular disc pores (fig. b): Averaged 4 μ in diameter (2.9–4.3; 43); 8 on head, 2 on thorax, a marginal and a submedian row on each side of abdomen.

Setae: Body setae hairlike (fig. c), 4.9 μ long (2.9–7.2; 30). Two setae on margin of head between antennae, length 12.7 μ (10–18.7; 5). Stout setae (fig. d), on abdominal segments V–IX, 7.4 μ long (5.7–10; 24), gradually increasing in size toward the apex of abdomen. Apical setae 52.2 μ long (44.6–57.6; 4). One seta, 8 μ long (7.2–8.6; 6), associated with each apical seta.

Anal tube: 16.2 μ long (14.4–20.2; 4); width 5 μ (4.3–5.7; 4).

Anal ring: Without pores or other recognizable structures, located on the protruding apex of abdomen, surrounded by 4 sharp spines (fig. e) 10.2 μ long (8.6–12.9; 17).

VENTRAL SURFACE

Eye bases: 3.4 μ in height (2.9–4.3; 9); 8.6 μ in diameter (7.2–10; 9).

Antennae: Five-segmented, separated by 16.3 μ (11.5–20.2; 3). Total length 64.8 μ (59–69; 8). Length of segments (in microns) I, 13.9 (11.5–15.8; 9); II, 12.4 (11.5–14; 9); III, 10.5 (8.6–12.9; 10); IV, 8.8 (7.2–10; 10); V, 18.1 (15.8–20; 10). Terminal segment with 3 slender setae; their length 30.7 μ (24.5–36; 26). Fleshy setae on segments IV and V, 11.2 μ long (8.6–15.8; 27). Hairlike setae on all segments, except IV, 8 μ long (5.7–12.9; 23). One sensorium on segment II.

Labium: Triangular in shape, 34.8 μ long (25.9–57.6; 6); width 33.6 μ (31.7–36; 6), with 1 long and 3 short setae on each side. Length of stylet loop 172 μ (151–180; 6). Clypeolabral shield oval, with two hornlike structures. Length of shield 58.6 μ (57.6–60.5; 6); width 44.4 μ (39–47.5; 6).

Legs: Well developed. Length of thoracic legs as follows (in microns): Prothoracic legs: coxa, 13.9 (11.5–15.8; 6); trochanter, 11.7 (10–15.8; 7); femur, 31.9 (28.8–33; 7); tibia, 13.7 (12.9–14; 6); tarsus, 14.6 (12.9–15.8; 6); claw, 9.5 (8.6–11.5; 5). Mesothoracic legs: coxa, 15.7 (12.9–20; 8); trochanter, 11.8 (10–14; 6); femur, 31.8 (28.8–34.5; 9); tibia, 12.8 (10–14; 9); tarsus, 14.7 (12.9–17; 9); claw, 10.7 (8.6–12.9; 7). Metathoracic legs: coxa, 15.2 (11.5–17.3; 9); trochanter, 11.5 (10–15.8; 6); femur, 32.3 (28.8–36; 11); tibia, 14 (11.5–15.8; 10); tarsus, 15.5 (14–17.3; 9); claw (fig. f), 11.7 (10–14; 9).

Spiracles: Anterior pair (fig. g), 13 μ long (11.5–14; 7); atrium 4.5 μ wide (4–5.7; 7), with one trilocular disc pore 2.9 μ in diameter. Posterior pair, 13 μ long (11.5–14; 8); atrium 4.5 μ in diameter (4–5.7; 7), with one trilocular disc pore 2.6 μ in diameter (1.4–2.9; 6).

Quadrilocular disc pores (fig. i): 2.9 μ in diameter, two or more scattered on some abdominal segments.

Trilocular disc pores (fig. h): 2.9 μ in diameter, located in one submarginal row on abdominal segments IV–VIII; 1 pore at base of each prothoracic and mesothoracic coxa.

Setae: Two setae between antennae, 17.4 μ long (14.4–21.6; 9). Setae on margin of abdominal segments V–IX (fig. j) 8 μ long (5.8–11.5; 7), gradually increasing in length toward apex of abdomen. Other setae hairlike, 4.8 μ long (4.3–7.2; 11).

Material studied: Nine nymphs mounted on 2 slides were available for this description. The specimens were received from Dr. W. R. Richards, Ottawa, Canada. They were collected on bark of sugar maple, *Acer saccharum,* at Sault Ste. Marie, Ontario, Canada, by O. H. Lindquist. No collecting date was given.

Holotype Female.—From *Acer saccharum* Marsh., North of Perry, Vermont, 1 Nov. 1966, coll. R. L. Murray, deposited in the U. S. National Museum (USNM). Paratypes.—All specimens collected from sugar maple, *Acer saccharum* Marsh. U.S.A., MAINE: Limerick, 1 ♀, 27 June 1967; coll. M. Kosztarab, (VPI). NEW HAMPSHIRE: Ellsworth, 8 ♀, 8 slides, 4 Jan. 1966; coll. A. H. Mason and R. H. Hutchins, (USNM). NEW YORK: Tioga County, 6 ♀, 1 slide, Oct. 1965; coll. C. Hebdon, (USNM 65–26555, #2). VERMONT: Near Granville, in Green Mt. Nat. Forest, 23 ♀, 11 slides, Oct. 1965; coll. R. Ford, (VPI; one of the paratype slides deposited in the British Museum, one in the Ferris-McKenzie Collection in Davis, California). —North of Perry, 33 ♀, 27 slides, 1 Nov. 1966; coll. R. L. Murray, (18 slides Cal. Dept. Agr.; 10 slides Fla. Dept. Agr.).—Smugglers Notch Forest Service near Information Office, (Lamoille Co.), 10 ♀, 2 slides, 24 June 1967; coll. Eva and M. Kosztarab, (VPI). No locality given, 6 ♀, 1 slide, Oct. 1965; coll. R. Ford, (USNM 65–26555 #1). CANADA: Ontario, Sault Ste. Marie, 13 ♀, and 9 crawlers, 8 slides, (no date); coll. O. H. Lindquist, (VPI).

Distribution: In addition to the above-listed collections, this scale insect species was reported from a few localities in Maine, central and northern New York, from most of the counties of New Hampshire, and Vermont, also from some parts of Ontario and Quebec in Canada.

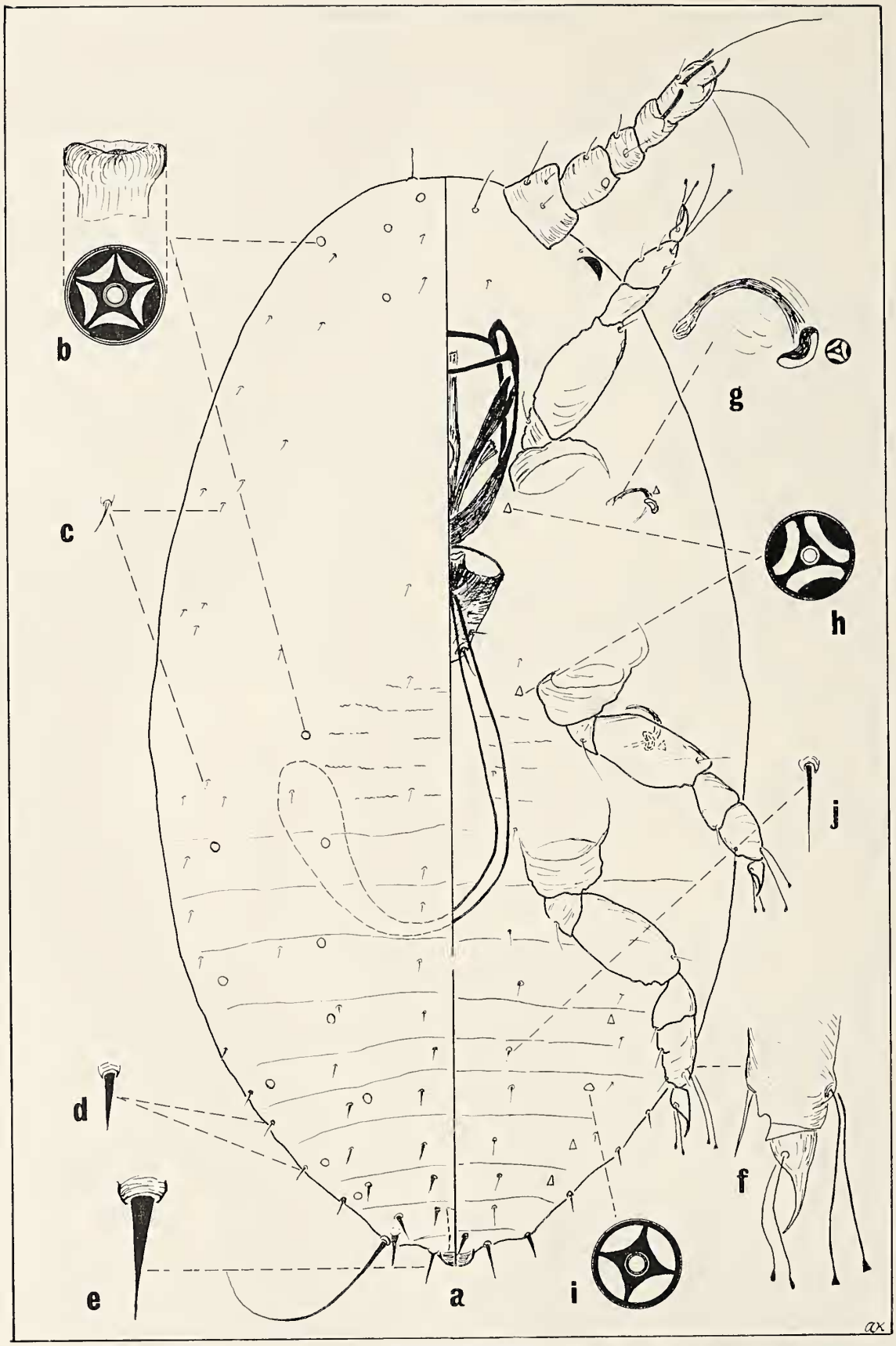

Plate 2.– Cryptococcus williamsi sp. n., first instar nymph

Biological Data: Little information is available on the biology and ecology of this species. The U. S. Forest Service, Amherst Zone, Massachusetts, initiated studies of this nature by its cooperators in New England States. Information was kindly supplied through personal correspondence with Mr. A. R. Hastings, Entomologist at Amherst. Observations were also made by Kosztarab in Vermont and Maine in June 1967. Crawlers were found in late May and early June in New Hampshire by Mr. Arthur Mason, Assistant State Entomologist, who observed that the eggs hatch 10–15 minutes after being laid. Mr. Theodore Walker observed the crawlers to be born alive, viviparously. Females collected at Bartlett, New Hampshire, from red maple (the only record from this host), and dissected by the cooperators, had 20 to 30 eggs per female. Mr. Elwin Leysath observed about the same number of eggs in females from sugar maple. The contradictions about the birth of these insects should be clarified in the future.

Infestation is much more easily detected on young trees with smooth bark than on old trees with deep bark crevices. In the latter case, to find the scale insects it is necessary to remove the thick bark flakes until the new bark growth is reached. Because of the shortness of their stylets, the insects can feed only through thin young bark. Cooperators and the senior author observed heavier infestations of this species on the north and northwest sides of tree trunks, than elsewhere.

According to Mr. Hastings, in the early winter the coccid is covered with a thick coating of the filaments of white waxy secretion. In late winter and early spring this coating is worn thin and the female is visible in the bark crevices.

Parasites and Predators: Material collected at Ellsworth, New Hampshire, was infested by a parasitic wasp, *Coccophagoides* sp. Eulophidae (det. Dr. J. G. Conklin). Only low-level parasitism was observed.

Economic Importance: No attempt has been made to evaluate the impact of this scale on infested trees. It could be assumed, from closely related species, that in case of heavy infestation, especially on young trees, this new scale insect might cause severe injury or death to trees because of excessive sap loss due to the feeding of the insects.

This coccid could probably cause indirect damage to the infested trees by dispersing mechanically or biologically maple-tree diseases, such as anthracnose, phyllosticta spot, tar spots, leaf scorch, verticillium wilt, and others. A closely related species, the beech scale, *Cryptococcus fagi,* developed an insect-disease complex, the beech scale-nectria, therefore the potential of this new species for developing such an insect-disease complex is great. Because the production and processing of sugar-maple lumber and syrup are multimillion-dollar industries in North America, more research should be conducted to clarify the biology, ecology, and possible control of this insect.

This species is named in honor of Dr. Douglas J. Williams, coccidologist of the Commonwealth Institute of Entomology, who also studied the taxonomy of the insect, compared some of our adult specimens with the adults of *C. aceris* in the British Museum, and who kindly accorded us the privilege of describing this new species.

KEY TO THE ADULT FEMALES OF CRYPTOCOCCUS

1	Antennae four-or five-segmented	*aceris* Borchs.
	Antennae one- or two-segmented	2
2(1)	Six anal-ring setae present; known from *Hoheria* species	*nudatus* Brittin
	Four anal-ring setae present; known from *Fagus* and *Acer*	3
3(2)	Anal ring surrounded by 6 large setae; cluster pore plate poorly developed, without pores; known from beech, *Fagus*	*fagi* Baer.
	Anal ring surrounded by 10 large setae; cluster pore plate well developed, and with pores clearly visible; known from maple, *Acer*	*williamsi* Krb. and Hale

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